

Appl. No.: 10/716,232
Armdt. dated: March 1, 2006
Reply to Office Action of: November 1, 2005

Amendments to the Specification:

Please add the following three new paragraphs after the paragraph ending on page 4, line 4:

—One embodiment disclosed herein is a method of producing propylene from ethane comprising the steps of (a.) steam cracking an ethane or primarily ethane feedstock thereby producing a cracking product containing ethylene, hydrogen, ethane, methane, acetylene and C₃ and heavier hydrocarbons; (b.) treating the cracking product in an ethylene plant recovery section including removing the hydrogen, methane and C₃ and heavier hydrocarbons therefrom and converting the acetylene therein primarily to ethylene to thereby produce a treated cracking product containing primarily ethylene and ethane and including fractionating the treated cracking product in a C₂ fractionator and obtaining an ethylene fraction of chemical grade ethylene having an ethylene content of less than 99% by volume and a bottoms ethane fraction; (c.) recycling the bottoms ethane fraction to the steam cracking; (d.) reacting by dimerization in a dimerization section a first portion of the ethylene fraction thereby producing a butene-rich stream; (e.) reacting by metathesis in a metathesis section the butene in the butene-rich stream with a second portion of the ethylene fraction thereby producing a propylene-rich stream containing propylene, ethylene and ethane; (f.) separating propylene from the ethylene and ethane in the propylene-rich stream, and (g.) recycling at least a first portion of the ethylene and ethane from the propylene-rich stream to the C₂ fractionator.

Another preferred form of the invention is a method of producing propylene from a hydrocarbon feedstock comprising the steps of (a.) steam cracking the hydrocarbon feedstock thereby producing a cracking product containing ethylene, hydrogen, ethane, methane, acetylene and C₃ and heavier hydrocarbons; (b.) treating the cracking product in an ethylene plant recovery section including removing the hydrogen, methane and C₃ and heavier hydrocarbons therefrom and converting the acetylene therein to ethylene to thereby produce a treated cracking product containing primarily ethylene and ethane and including fractionating the treated cracking product in a C₂ fractionator and obtaining a chemical grade ethylene fraction having an ethylene

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content less than 99% by volume and a bottoms ethane fraction; (c.) recycling the bottoms ethane fraction to the steam cracking; (d.) reacting the chemical grade ethylene fraction by metathesis in a metathesis section with butene thereby producing a propylene-rich stream containing ethylene and ethane; (e.) removing the ethylene and ethane from the propylene-rich stream in a metathesis section deethanizer; and (f.) recycling at least a first portion of the removed ethylene and ethane to the C₂ fractionator .

Yet another embodiment is a method of producing propylene from ethane comprising the steps of (a.) steam cracking an ethane or primarily ethane feedstock thereby producing a cracking product containing ethylene, hydrogen, ethane, methane, acetylene and C₃ and heavier hydrocarbons; (b.) treating the cracking product in an ethylene plant recovery section including removing the hydrogen, methane and C₃ and heavier hydrocarbons therefrom and converting the acetylene therein primarily to ethylene to thereby produce a treated cracking product containing primarily ethylene and ethane and including fractionating the treated cracking product in a C₂ fractionator and obtaining a chemical grade ethylene fraction having an ethylene content of less than 99% by volume, a polymer grade ethylene fraction having an ethylene content of at least 99.5% by volume, and a bottoms ethane fraction; (c.) recycling the bottoms ethane fraction to the steam cracking; (d.) reacting by dimerization in a dimerization section a first portion of the chemical grade ethylene fraction thereby producing a butene-rich stream; (e.) reacting by metathesis in a metathesis section the butene in the butene-rich stream with a second portion of the chemical grade ethylene fraction thereby producing a propylene-rich stream containing propylene, ethylene and ethane; (f.) separating propylene from the ethylene and ethane in the propylene-rich stream, and (g.) recycling at least a portion of the ethylene and ethane from the propylene-rich stream to the C₂ fractionator. —

Please replace the paragraph beginning at page 7, line 20, with the following rewritten paragraph:

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--The ability to produce butene, either butene-1 or butene-2, by reacting ethylene with itself is also known to the industry and is called dimerization. Dimerization of ethylene to preferentially produce butene-2 is practiced commercially and is used in the present invention as a source of the feedstock for metathesis. ~~The butene-2 is reacted in the presence of a catalyst with ethylene to form propylene.~~ The conversion of the ethylene is less than 100% and typically about 80% or greater. The effluent 90 from the dimerization reactor 64 flows to the deethanizer 92 wherein unreacted ethylene and ethane in the overhead 94 are separated from the butene in the bottoms 96. The overhead 94 is mostly recycled at 98 back to the reactor 64 and a small purge 100 is withdrawn to again control the buildup of inerts, chiefly ethane. The deethanizer bottoms 96 flows to a butene separation 88 where the product butene 72 and a purge stream 102 are withdrawn. The product 72 then goes to the metathesis reaction 68 for the production of the propylene. The purges 80 and 100 from the deethanizers 75 and 92 can be recycled back to the recovery section of the ethylene plant, i.e., back to the deethanizer 46 or deethanizer 52 or preferably to the C₂ fractionator 58. Alternately, they can be recycled back to the charge gas compressor, although this is less preferable.--